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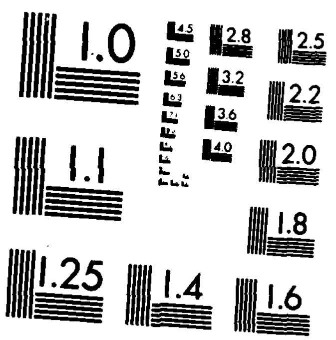

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NAVAL SUPPORT ACTIVITY HOSPITAL, DANANG, CASUALTY BLOOD UTILIZATION JANUARY TO JUNE 1968

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REPORT NO. 86-16

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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND

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Summary

Introduction

There is considerable importance in maximizing the efficient use of blood to treat combat casualties as soon as they arrive from the field. Management of this supply through planning that is based on past experiences so that appropriate amounts are available when needed is one way to help achieve this goal.

Methods

A surgical data base, containing medical information on 2,021 combat casualties admitted to the Naval Support Activity Hospital, Danang, South Vietnam, between January and June 1968, was used to provide information on the way whole blood was given to casualties from the time they were admitted until the end of their initial surgery. Variables that were used in this paper included wounding agents, time from injury to admission, time from admission to going to the operating room, admission hematocrit, and others.

Results

Of the 2,021 admissions, 516 (25.5%) were given a total of 3,148 units of blood (mean = 6.1 units). Most of these casualties (N = 118) were given two units and 48.8% of all casualties given blood received three units or less. Some blood was given almost every day of the study (97.2% of the time). "Artillery/rockets/mortars" caused the highest percentage of casualties (38.9%), and the highest percent of casualties that were given blood (32.4%). These casualties received 24.3% of the total amount of blood given. The wounding agent with the highest number of units per person was "Mine" (mean = 11.0).

Discussion

Most casualties were not given blood or were given small amounts. The weapons causing wounds had distinct implications for blood use. Important considerations are: (1) mix of weapons - the amount of particular weapon usage and its proportional usage compared to other weapons used at the same time, (2) the weapon's ability to cause a wound that requires any blood to be given, and (3) the type of weapons that cause wounds that require large amounts of blood to be given.

Introduction

The importance of front line military treatment facilities having a good blood supply to treat combat casualties as soon as they arrive cannot be overstated. Various sources have cited the high quality of medical care given to wounded servicemen during the Vietnam War (1,2), and specifically mentioned was the rapid and early institution of resuscitation and the large supply and frequent use of whole blood (1). Even though blood was reported to have been readily available to clinicians during the Vietnam War, it was regarded then, and is now, as a limited resource to be used conservatively and with maximum effectiveness. One way to achieve this goal is to extend the blood shelf life. Responding to this need, researchers have worked on a variety of storage and usage programs for many years since the Vietnam War, including developing ways to freeze, rejuvenate, and administer whole blood (3,4). Another way to maximize efficiency is through careful planning, especially that which is based on actual experiences. Understanding the way blood was used during the Vietnam War may provide insights about blood use in future conflicts, both for medical planners and for designers of medical information systems such as the Fleet Marine Force Combat Casualty Information System (5). The purpose of this paper was to describe the use of whole blood given to a group of Vietnam combat casualties between the time they were admitted to the Naval Support Activity Hospital, Danang, and the end of their initial surgery.

Methods

A surgical data base constructed by the Surgical Research Unit Staff, Naval Support Activity Hospital, Danang, was used in this study. It contains medical data on 2,021 male combat casualties (primarily United States Marines and Army soldiers) admitted to the Naval Support Activity Hospital, Danang, between January and June 1968. There were 2,008 casualties, 13 of whom were admitted twice during the six-month period. Additional information about the contents of the surgical data base and the methods used to construct it are found in other papers (6,7). Many of the variables in the data base were included in this study, but two of them, "units blood" and "admission hematocrit", will be described in detail. "Units blood" documented the number of units of whole blood given to casualties from the time they were admitted to the triage area of the hospital to the end of their first surgery. It should be emphasized that it did not include blood given after the initial surgery nor at any other time. Two of the authors (J.G. and L.C.) recall that almost all of the admissions came directly from the field and without any medical intervention, including not being given blood; however, it is known that there were a few cases (not identified) who were transfers from other medical facilities and may have been given blood before their arrival at the Naval Support Activity Hospital. "Admission hematocrit" was the variable that documented the results of the hematocrit test, done at the time the casualty was admitted to the triage area. Not all 2,021 admissions in the study had an admission hematocrit measured nor were all given blood. Missing data for "units blood" and "admission hematocrit" were indicated by coding "99" or providing no information. Patients not given blood or not having an admission hematocrit measured were coded "0", and these cases, together with those having "missing data", were not included in the analyses. In addition to the descriptive aspects of this study, it was hypothesized that the following variables might correlate with the amount of blood that was given:

"admission hematocrit", "time from the injury in the field to admission", "number of months on duty in Vietnam", and "number of days on a combat operation when the injury occurred". Thus, it was predicted that the amount of blood given would increase in the following situations: a low hematocrit, a lengthy transit time from the site of wounding to the hospital, being stationed in Vietnam a short time when the injury occurred (inexperience), and being on a lengthy combat operation (fatigue). The relationships of these variables to the number of units given was tested by Pearson product-moment correlations. A one-way analysis of variance (ANOVA) was performed to determine if the mean hematocrit differed significantly between those who were and were not given blood. An ANOVA was also performed to determine if the mean units of blood given differed significantly in those who did and did not have their admission hematocrit measured.

Results

Of the 2,021 admissions, 516 (25.5%) were given a total of 3,148 units of blood (mean = 6.1 units) during the six months of the study (0 units = 1,485, missing data = 20). Most of these 516 casualties (70%) had an admission hematocrit (mean = 36.5%) and they were given 2,355 units (mean = 6.5 units). A one-way ANOVA showed that casualties having their hematocrit measured received significantly more blood than casualties who did not ($F = 4.16$, $p = .04$). The other 155 casualties that did not have an admission hematocrit were given 739 units (mean = 5.1). Of 1,505 casualties who were not given blood, 486 had an admission hematocrit measured (mean = 41.0%). A one-way ANOVA indicated that casualties who received blood had a significantly lower admission hematocrit than casualties who did not receive blood ($F = 140.1$, $p < .001$). In Figure 1 is the

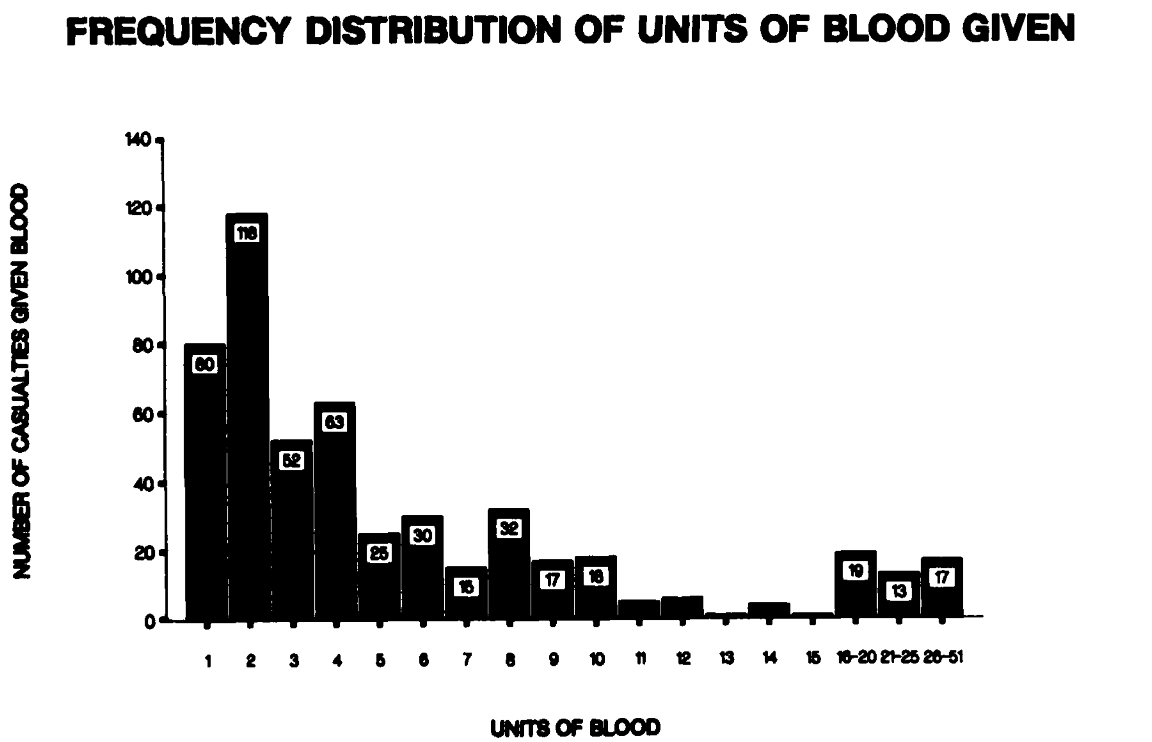

Figure 1

frequency distribution of the number of units of blood given. The greatest number of casualties (N = 118) received two units, and 48.4% of all casualties given blood had three units or less. The maximum number of units given to a casualty was 51.

Of all 2,021 admissions, there were 59 deaths (2.9%). Seventeen were judged to be non-salvageable at the time they were admitted and were not taken to the operating room or given blood. Of the 42 potentially salvageable deaths, 38 were given a total of 451 units of blood (mean = 11.9 units). The remaining 478 admissions that were given blood and surviv were given a total of 2,697 units (mean = 5.6 units).

Figure 2 indicates the number of casualties that were given blood per week. The number ranged from 4 to 42 casualties (mean = 19.8 units per week). Figure 3 shows the total number of units of blood given per week which r-nge from 10 to 362 (mean = 121.1 units per week). The three highest weekly amounts were in February which coincided with the beginning of the January 31 Tet offensive (8).

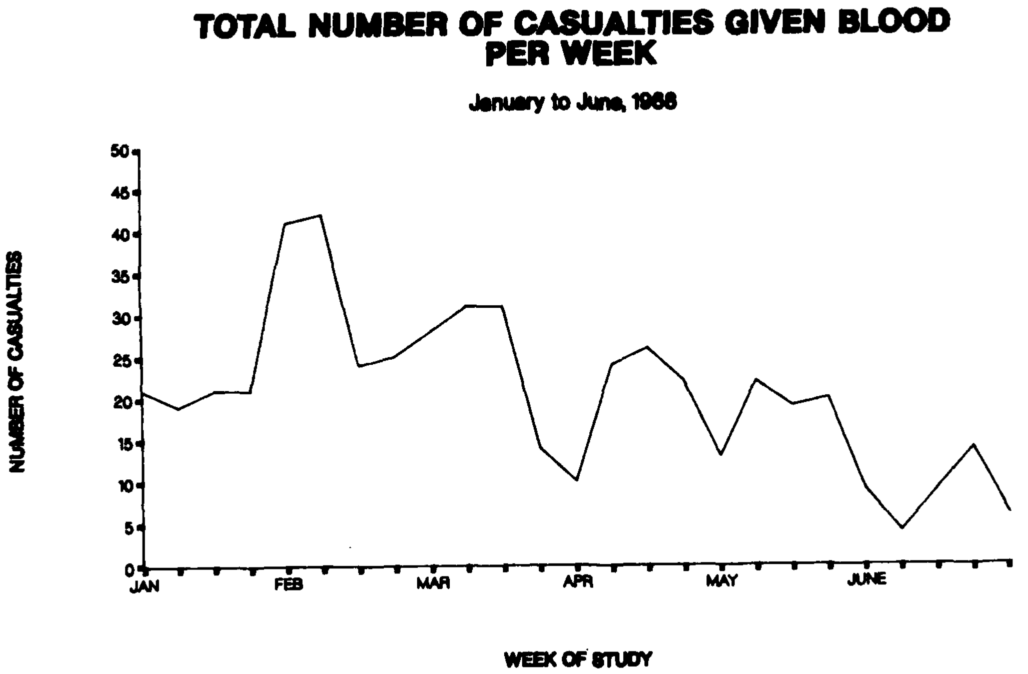

Figure 2

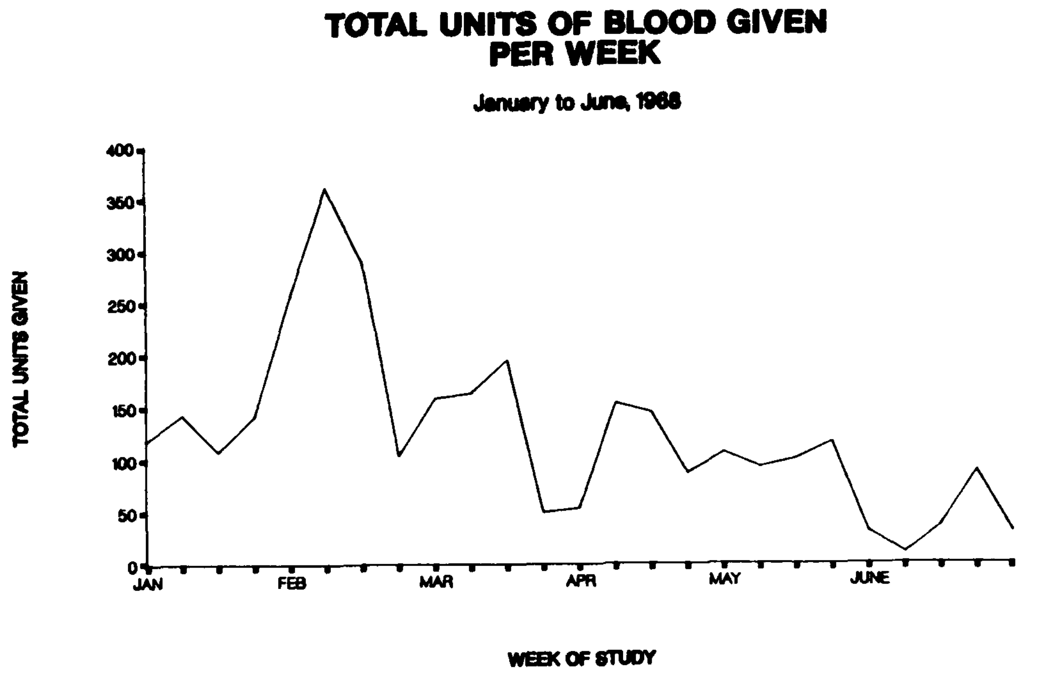

Figure 3

During the 181 days of the study, blood was given on 176 days (97.2%). Overall, the percentage of admissions that were given blood was 25.5%, but the daily percentage varied from 0 to 100%. On 104 days of the study 30% or less of the admissions were given blood, and there were only 22 days when the percent of admissions given blood was greater than 50%.

In Table 1 are wounding agents, the numbers of casualties that were given blood, the total and mean number of units given, and the percent of casualties for each wounding agent that required blood. "Multiple agents", "Not known", and "Other" were included in the table for completeness, but they were not considered in the following analysis because the specific wounding agents could not be identified. "Artillery/rockets/mortars" had the highest percentages of casualties (43.0%), casualties that were given blood (38.0%), and the total amount of blood given (28.8%). The least amount of blood was given for "Grenade/Mine/Booby-trap/Other", and no blood was given to casualties wounded by a "Burning agent". The wounding agent with the highest number of units per person was "Mine" (mean = 11.0 units). "Booby-trap grenade (SF)" and "(LF)" meant that the weapon had small or large fragments, and it was the "LF" category that had the highest percentage (57.4%) of casualties wounded that were given blood.

When "Mine", "Booby-trap grenade (LF and SF)", and "Grenade/Mine/Booby-trap/Other" cases were combined into one group, they accounted for 22.5% of all casualties, 32.6% of all casualties that received blood, and 53.9% of the total number of units of blood given.

Table 1

DISTRIBUTION OF BLOOD USE BY WOUNDING AGENT

Wounding Agent	Number of Casualties	Number of Casualties Given Blood	Percent of Casualties Given Blood	Mean Units	Number of Units Given
Rifle/Pistol	481	114	23.7	4.7	539
Artillery/Rockets/ Mortars	787	167	21.2	4.6	766
Mine	146	61	41.8	11.0	670
Thrown Grenade	147	15	10.2	4.2	63
Booby-Trap Grenade (LF)[a]	47	27	57.4	8.6	231
Booby-Trap Grenade (SF)[b]	187	50	26.1	7.5	373
Burning Agent	6	0	0.0	0.0	0
Grenade/Mine/Booby-Trap/Other	32	5	15.6	3.0	15
Multiple Agents	81	28	34.6	5.3	147
Not Known	86	45	52.3	7.2	324
Other	21	4	19.0	5.0	20
Total	2,021	516	25.5	6.10	3,148

[a] Large fragment
[b] Small fragment

Pearson product-moment correlations showed significant inverse relationships between "units of blood given" and "admission hematocrit" ($r = -0.322$, $p < .001$) and "time from injury to admission" ($r = -0.123$), $p = .004$). No significant correlation was found between "units of blood given" and "number of months on duty in Vietnam" ($r = -.057$, $p = .119$) or "number of days on a combat operation when the injury occurred" ($r = -0.020$, $p = .338$).

The casualty given the greatest amount of blood (51 units) was a 24 year old Marine with six years active duty. He was admitted 45 minutes after being injured by a mine with the following wounds: traumatic amputation of the left leg below the knee, and injuries to the right forearm, hand, thigh, leg and genitalia. He came to the Naval Support Activity Hospital when only one other casualty was in triage at the time of his admission, and he was there for 3.3 hours before being taken to the operating room. His admission hematocrit was 37%. He was given general anesthesia and stayed in the hospital for five days. He was released alive and air-evacuated to a western Pacific hospital.

Discussion

Planning of future blood requirements should involve reviewing past experience. To the extent that future combat situations are similar to the Vietnam War, the information provided in this study could, along with other data, be used for planning purposes. The results of this study indicated that most of the casualties were not given blood, and of the casualties that were given

blood, most were given small amounts (four units or less). But there were notable exceptions to this, with some casualties being given much larger amounts. Likewise, the daily percentage of casualties that were given blood was generally low, but sometimes it reached 100%. (Note: generally few casualties were admitted on low blood use days). As expected, the intensity of battle and the number of soldiers exposed to enemy fire related to the number of casualties requiring blood and thus to the amount that was given: the peak numbers for both occurred shortly after the beginning of the Tet offensive.

Each of the weapons or groups of weapons cited in this study had separate and distinct implications for blood use. In this study "Artillery/rockets/mortars" caused most of the wounds and on this basis alone were associated with a greater amount of blood given. It could be that these weapons were used more often and in higher proportions than other weapons and/or that they were more effective in causing wounds because of their construction. However, casualties wounded by mines required more units of blood per casualty than any other group, and the wounding agent category with the greatest percentage of its casualties given blood was booby-trap grenade with large fragments, as this weapon tended to mangle. In another study, it was found that this weapon was associated with a high percentage of deaths (8).

The use of booby-traps and mines in Vietnam is well known. When these weapons were combined as a group, they accounted for a relatively small percentage of the casualties but a disproportionately high amount of the total amount of blood given. Therefore, these weapons were important to medical personnel because of the disproportionate use of blood, and, by implication, wound severity and the use of other resources.

It was thought that "number of months on duty in Vietnam" and "number of days on a combat operation when the injury occurred" might predict the amount of blood given. This was not found to be the case, although the associations were in the direction expected. "Time from injury to admission" was significantly correlated with blood use; the casualties with shorter transport times were given more blood. This could be the result of the higher priority given to evacuating the more seriously wounded. "Admission hematocrit" did relate to the amount of blood given as predicted; casualties with lower hematocrits were more likely to be given blood. In an environment where decisions must be made quickly, it appears that the additional time needed to give this test is beneficial for casualty care and resource management. During the study blood samples had to be taken to the laboratory and reported back to the triage area. Having a centrifuge in the triage area (during the study blood was taken to the laboratory) could provide clinicians with important information in a more timely manner.

The mean amount of blood given to casualties who were treated but eventually died was about double that given to survivors. This fact reflected the medical system's capacity to respond to the needs of all of the casualties and that large amounts of blood were given in heroic attempts to save lives. In the case of the Marine that was presented, it was an investment that resulted in a successful outcome.

REFERENCES

1. Maughon JS: An inquiry into the nature of wounds resulting in killed in action in Vietnam. Milit Med 1970;135:8-13
2. Arnold K, Cutting RT: Causes of death in United States Military personnel hospitalized in Vietnam. Milit Med 1978;143:161-164
3. Valeri CR, Sims KL, Bates JF, et al: An integrated liquid-frozen blood banking system. Vox Sang 1983;45:25-39
4. Valeri CR, Valeri DA, Anastasi JJ, et al: Freezing in the primary polyvinylchloride Plastic Collection Bag: A new system for preparing and freezing nonrejuvenated and rejuvenated red blood cells. Transfusion 1981;21(2):138-149
5. Gunderson EKEG, Congleton MW, Ramsey-Klee DM: Proceedings of the conference on fleet marine force combat casualty information system. Naval Health Research Center Report No. 84-15, San Diego, California, 1984
6. Garrick J, Carey LC: Report of the Bureau of Medicine and Surgery on Battle Casualty Meeting. Washington, DC: 1973
7. McCaughey BG, Garrick J, Carey LC, et al: Naval Support Activity Hospital, Danang, combat casualty study. Naval Health Research Center Report No. 86-1, San Diego, California 1986
8. Karnow S: Vietnam: A History. The Viking Press: New York, 1983
9. McCaughey BG, Garrick J, Kelley JB: Naval Support Activity Hospital, Danang, Combat Casualty Deaths, January to June 1968. Naval Health Research Center Report No. 86-11, San Diego, California 1986

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A surgical data base, containing medical information on 2,021 combat casualties admitted to the Naval Support Activity Hospital, Danang, South Vietnam, between January and June 1968, was used to provide information on the way whole blood was given to casualties from the time they were admitted until the end of their initial surgery. Of the 2,021 admissions, 516 (25.5%) were given a total of 3,148 units of blood (mean = 6.1 units). The greatest number of casualties (N = 118) were given two units, and 48.8% of all casualties given blood were given three units or less. Some blood was given almost every day of the study

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